USING THE FOREST ECOSYSTEM SERVICES TOOLKIT (FEST) TO ASSESS THE IMPLICATIONS OF BIOMASS HARVESTING ON ECOSYSTEM SERVICES

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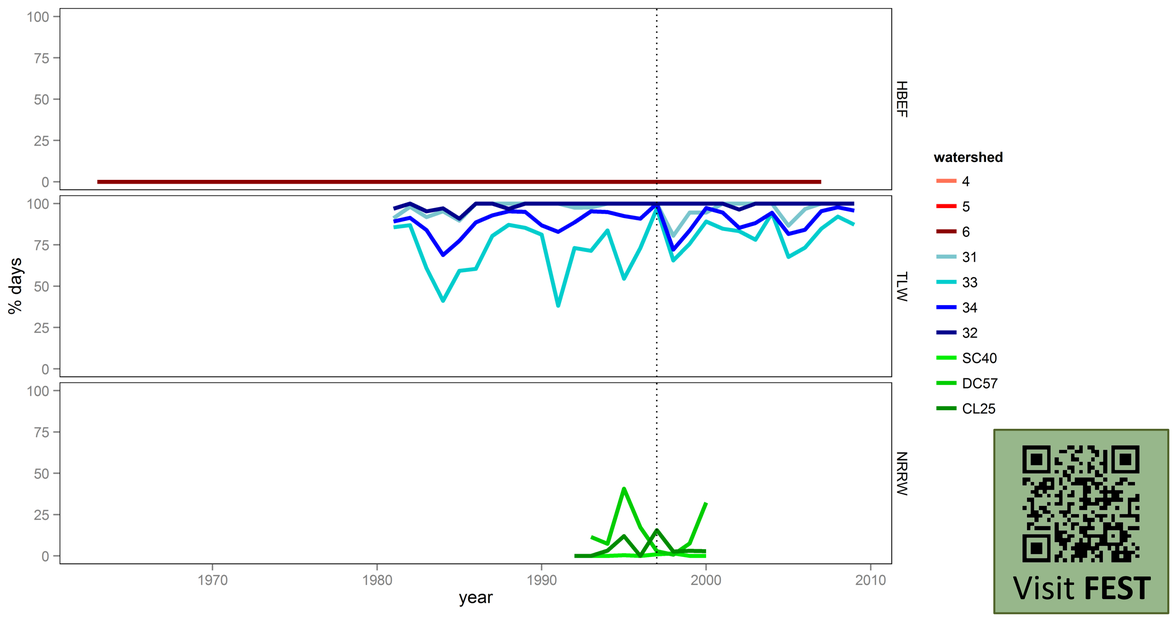

Figure 1. Percentage of days that pH was maintained within national drinking water standards.

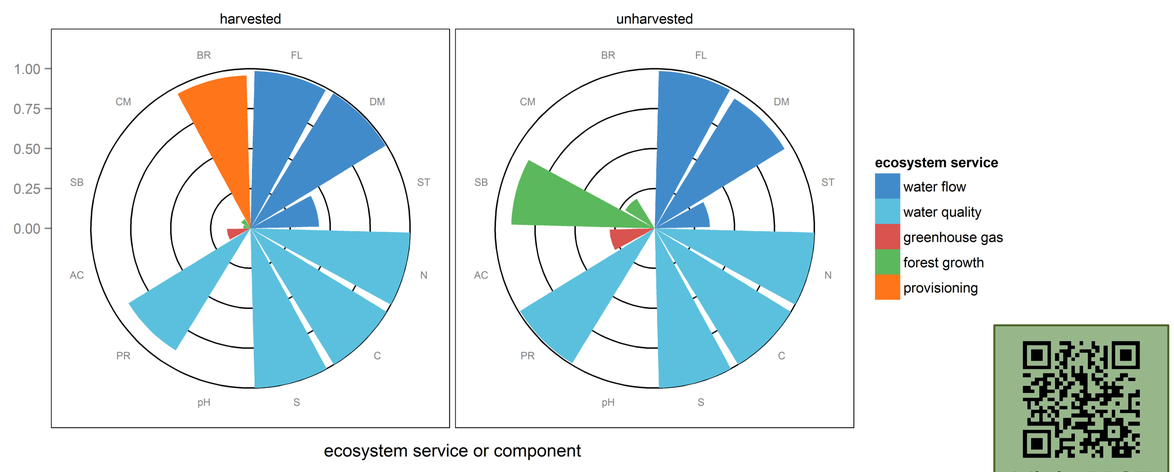

Figure 2. Tradeoffs among ecosystem services at a harvested (5) and reference watershed (6) at HBEF, 5 years after harvest. FL = flood regulation, DM = drought mitigation, ST = flow stability, N = nitrate regulation, C = chloride regulation, S = sulfate regulation, pH = pH regulation, PR = pollution remediation, AC = aboveground carbon, SB = standing biomass, CM = tree composition, BR = biomass removals.

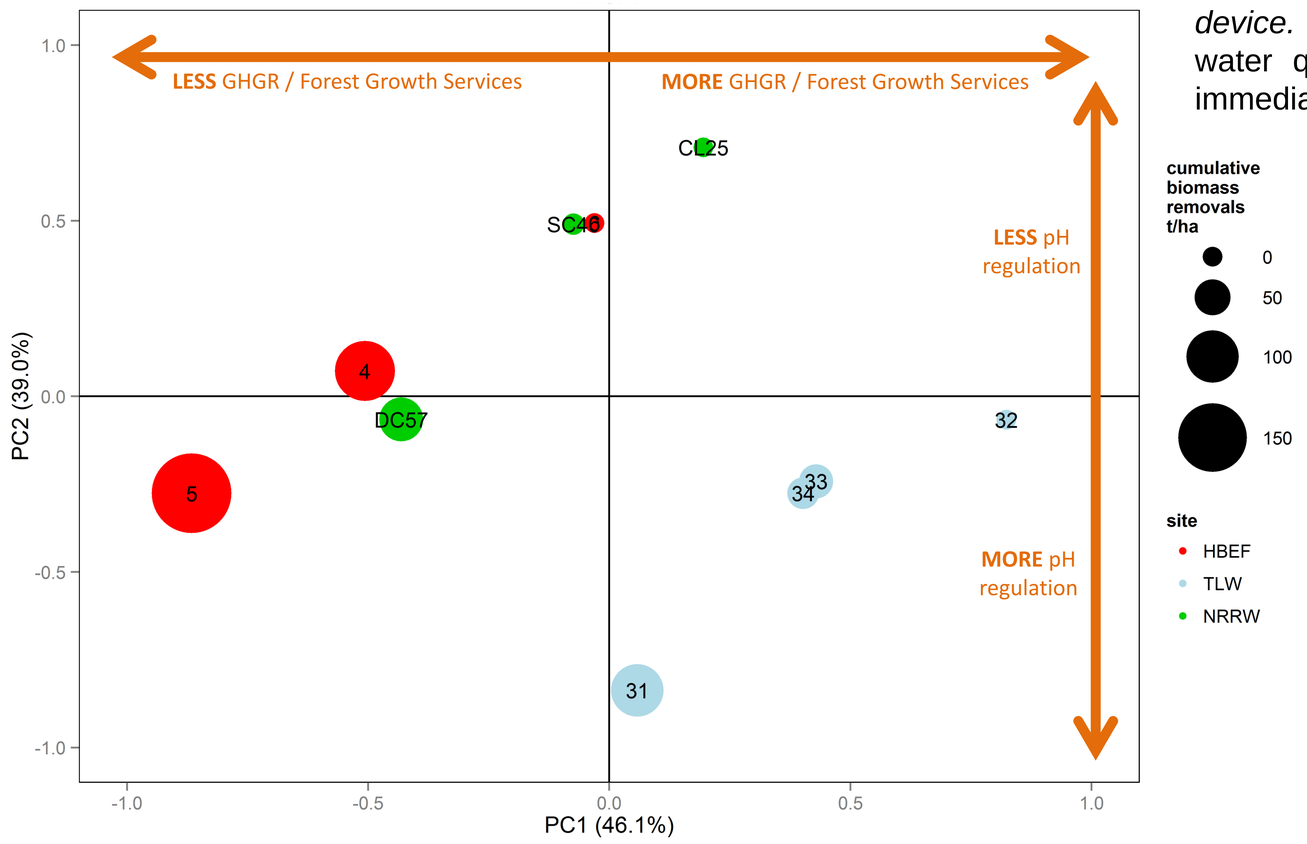

Figure 3. Results of a principal components analysis based on provision of ecosystem services at 10 research watersheds in northeastern North America during a 5-year post-harvest period.

Introduction: The Forest Ecosystem Services Toolkit (FEST) is a collaborative effort to couple long-term ecological data with contextual social information to generate dynamic measures of ecosystem services. FEST allows users to explore how forest management, climate change and pollution shape the capacity of forest watersheds to deliver essential and desirable services to human populations at multiple scales. The initial focus of FEST is on regulating and supporting services, such as the capacity of forest watersheds to provide high quality water to meet multiple human needs or the ability of forests to self-regulate growth of biomass for use as timber, energy feedstocks, carbon storage, or wildlife habitat. It is hoped that FEST outputs will be valuable to regulators and policy-makers hoping to understand how the flow of ecosystem services from forests may change under multiple scenarios of management, land use, climate change, and acid deposition.

Methods: In this case study, we analyzed changes in twelve ecosystem services at 10 watersheds at three sites – both before and after treatment watersheds were harvested. Research sites included Hubbard Brook Experimental Forest (HBEF), Turkey Lakes Watershed (TLW), and the Neversink River Research Watershed (NRRW). Services were quantified in absolute terms as well as rescaled on a [0,1] scale. Principal components analysis (PCA) was used to analyze the similarity of watersheds in terms of the rescaled services. More information about our methods, including details about how we calculated each of the twelve service metrics, is available on the FEST website.

Results: The time-series values for individual service metrics reveal possible changes in service provision resulting from harvesting, as well as inherent variability in baseline service provision among watersheds and sites. For example, adequate pH regulation was achieved at more than 40% of measurement days at TLW, whereas this service was absent or rare at HBEF and NRRW (Figure 1). Rescaled service metrics reveal patterns in tradeoffs among services. For example, comparing a harvested to a treatment watershed at HBEF reveals short-term tradeoffs between biomass harvesting (provisioning service) and regulating services associated with greenhouse gas regulation (GHGR) and services associated with forest growth (Figure 2). Biomass harvesting does not appear to strongly affect water regulation services. The results of the PCA (Figure 3) illustrate tradeoffs among services across all of the watersheds. The first component is largely determined by the aforementioned tradeoffs between harvesting and GHGR / forest growth services. The second component includes relatively large loadings for pH regulation, drawing distinctions between the watersheds at TLW, where pH was adequately regulated, and HBEF/NRRW, where it was not. *Interactive versions of these figures, as well as many others, can be accessed on the FEST website by scanning the QR codes on this poster with a mobile device.* In general, results support the hypothesis that regulation of water flow and water quality by these forests is not impacted by biomass harvesting, whereas immediate short-term impacts on GHGR and supporting services are apparent.